Tracking stem cells using tricks learned in outer space

Posted: July 28, 2011

Created: 28/07/2011 - 08:20

Stem cell science is set to get a boost from an unlikely source: outer space. It turns out that techniques devised to help telescopes peer through the blur of the earth's atmosphere could help scientists peak more deeply into tissues. If the technique, called adaptive optics or AO, works it might prove useful for scientists hoping to track the whereabouts of transplanted stem cells.

A group of researchers at the University of California, Santa Cruz, including CIRM grantee Joel Kubby, have formed the W. M. Keck Center for Adaptive Optical Microscopy, which will apply AO techniques to microscopes built for peering deep into tissues.

A press release from UCSC describes the project:

" Principal investigator Joel Kubby, an associate professor of electrical engineering in the Baskin School of Engineering at UCSC, has worked on adaptive optics (AO) systems for large telescopes as well as for biological imaging. In astronomy, AO systems correct the blurring of telescope images caused by turbulence in the Earth's atmosphere. In microscopy, blurring is caused by the flowing cytoplasm of living cells.

"We can get beautiful images of cells close to the surface of the tissue, but if you want to go deep you're out of luck because of the degradation of the image. That was the motivation for this project," said co-investigator William Sullivan, professor of molecular, cell, and developmental biology at UC Santa Cruz. "For cell biologists, anything that improves imaging is a big deal, and this has the potential to open up vast areas of cell biology that have been opaque to us."

In stem cell research, for example, an important bottleneck in efforts to develop stem cell therapies has been the inability to follow injected stem cells and monitor their fates below the surface of the tissue. AO microscopy could solve this problem, and the California Institute for Regenerative Medicine (CIRM) has provided support for the work at UCSC, including funding that led to the development of the team's first AO microscope.
Knowing where a stem cell goes once it has been transplanted is critical to developing new therapies. Unless they go to where the damage is and stay there, those cells won't hold any long-term therapeutic benefit. Tracking cells within tissues could point to better ways of transplanting the cells and, eventually, to more effective therapies.

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Tags: kubby, Tools and Technologies, University of California Santa Cruz